Can research benefit of real-time GPS collars conceived for livestock management by farmers?

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Introduction. In the last 20 years, the advent of global positioning system (GPS) collars has greatly enhanced the research on livestock spatial distribution in rangelands. Conventional GPS collars (CC) are used on sample animals whose positions are recorded on-board at a high acquisition rate, even in rough environments. In the last few years, real-time position monitoring collars (RTMC) have been developed to support livestock management by farmers. They are generally equipped on all the animals of the herd and transmit the positions to an antenna, which sends the data to a server via GSM network. Farmers can check animal positions in real time by using a smartphone or personal computer. The aim of this study was to evaluate if data gathered by RTMC in rough mountain pastures fulfil research needs to assess vegetation community selection by livestock and the factors affecting livestock spatial distribution with a similar pattern to CC data.

Materials and methods. In summer 2020 (Vogna valley - NW Italian Alps), all adult animals (51 cows) and 7 adult cows from a herd of 68 Highland cattle were equipped with RTMC (30-min recording interval) and CC (10-min recording interval), respectively. Within a paddock of 59 ha, 24 vegetation surveys using a vertical point quadrat method (Daget and Poissonet, 1971) were carried out to identify the main vegetation groups. Forage Pastoral Value was calculated according to Daget and Poissonet (1971). The GPS fixes for RTMC and CC for the period 10/9-21/9 were selected. Preference indexes for each vegetation group were computed as the proportion of GPS fixes within a group divided by its proportional area (Manly et al. 2002). To study livestock spatial distribution, the paddock was subdivided into 10×10m grid cells and the number of RTMC and CC fixes were counted within each cell. The counts were modelled as a function of vegetation and topographic variables, i.e. green alder (*Alnus viridis*) cover, Pastoral Value, slope, and the distance from water sources using Generalised Linear Models.

Results. Even though the number of animals equipped with RTMC and CC and the recording interval were different, the number of recorded fixes was similar (12871 and 12093 overall, respectively), mainly because of the lower acquisition rate of RTMC (48.92% ± 2.2, mean ± se) compared with CC (99.98% ± 0.02). RTMC are not provided with an on-board memory and communication failure with the antenna results in data loss. However, preference indexes and the effect of factors affecting livestock spatial distribution were highly comparable between the RTMC and CC (Fig 1).

Conclusions. Since RTMC were not equipped with an internal memory, data loss affected the acquisition rate negatively. Nevertheless, being almost all the animals equipped with RTMC, the overall conclusions derived from research results were comparable to those provided by CC. Installing an internal memory would improve the representation of the entire herd spatial distribution.

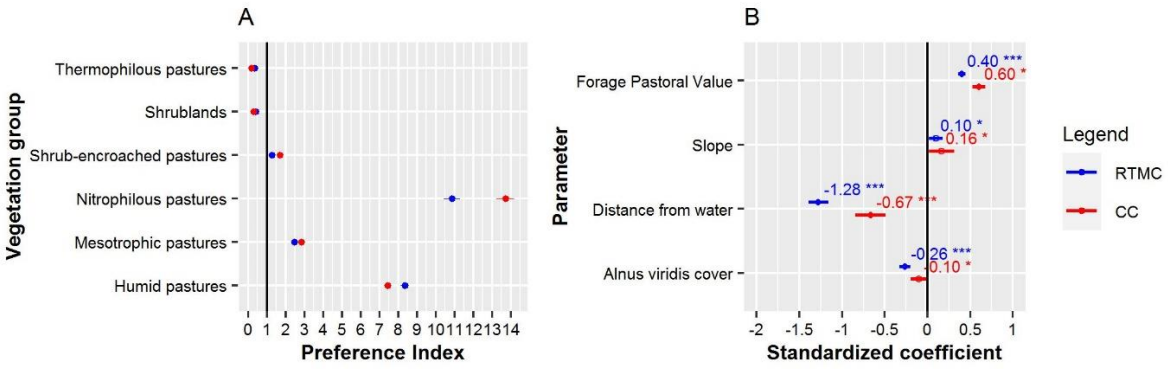

Figure 1 – A) Preference Indexes for each vegetation group and B) results of Generalised Linear Models showing the effects of vegetation and topographic variables on spatial use by livestock with real-time position monitoring collars (RTMC) and conventional collars (CC), respectively.

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